

A PRELIMINARY INVESTIGATION INTO THE EFFICACY OF INTRAPERITONEAL VACCINATION OF SHEEP AND GOAT KIDS AGAINST HEARTWATER

L. R. HURTER^(1,2), Generaal Mullerstraat 111, Welgelegen, Pietersburg 0699

ABSTRACT

HURTER, L. R., 1987. A preliminary investigation into the efficacy of intraperitoneal vaccination of sheep and goat kids against heartwater. *Onderstepoort Journal of Veterinary Research*, 54, 507-508 (1987).

The intraperitoneal route was explored both as an alternative to the intravenous route for the vaccination of sheep and goat kids against heartwater and for the administration of an antibiotic to animals suffering from the disease. Only 8 (57 %) of the 14 adult sheep, and none of the 7 goat kids, were found to be immune after intraperitoneal vaccination with infective blood. However, this route was found to be very suitable and effective for the administration of tetracyclines to reacting animals.

INTRODUCTION

Heartwater is one of the most important limiting factors in small stock farming in the Bushveld areas of the Republic of South Africa. The intravenous administration of a "vaccine" consisting of heartwater-infected blood to lambs and kids under the age of 3-4 weeks is a difficult procedure for the average stock farmer and is not readily attempted. Even in adult small stock, and to a lesser extent in calves, many farmers find this procedure a difficult one.

An easier but effective route for the administration of the vaccine would greatly increase the small stock farming potential in the farming areas of South Africa affected by heartwater. It was therefore decided that the feasibility of using the intraperitoneal route for introducing the infected blood should be explored. This route has been attempted only once previously, when Alexander (1931) failed to immunize 2 sheep.

EXPERIMENTAL PROCEDURE

Two experiments were conducted; in the first, 20 adult sheep were used and in the second, 7 goat kids.

Experiment using adult sheep

The sheep were housed in brick show pens with concrete floors and an iron roof. These pens were encircled by a cement drainage furrow and the terrain around them was cleared of any form of vegetation.

Before the experiments were started the pens and their surroundings were sprayed daily for 4 days with a Toxaphene dipwash and thereafter at weekly intervals. During the whole period of the experiment the drainage furrows were kept filled with the dipwash.

Twenty heartwater-susceptible Merino ewes were transported by rail from the Ermelo District, which is known to be heartwater-free. On their arrival at Potgietersrus the sheep were sprayed with dipwash, dosed with Thiabendazole and ear-tagged. They were fed a ration consisting of lucerne hay obtained from the Orange Free State (a heartwater-free area) and balanced pellets.

Two days after their arrival they were randomly divided into 3 groups containing 14, 3 and 3 animals respectively. Each of these groups was treated differently, as follows.

Intraperitoneal vaccination group

This group consisted of 14 animals, each of which was inoculated intraperitoneally with 5 ml heartwater blood vaccine obtained from the Veterinary Research Institute, Onderstepoort, in the following manner.

With the animal in a standing position, an injection site in the right sub-lumbar fossa, halfway between the last rib and the point of the hip and 2,5 cm ventral to the transverse process of the lumbar vertebrae, was used. A 25 mm long 17 g record needle was inserted and aimed, in an inward, downward and backward direction, at the left hock joint. (This method of injection was based on previous trials, using dead sheep as subjects, in which indicator dyes were inoculated instead of the vaccine. In no case was the introduced material deposited in the gut lumen or in the capsula adiposa of the fat of the right kidney.)

Intravenous vaccination group

Three sheep were injected intravenously (i.v.) with 5 ml infective blood.

Untreated control group

Three sheep were left as unvaccinated controls.

Post vaccination treatment of all 3 groups

On the day of vaccination, and for a period of 21 days thereafter, rectal temperatures of all the sheep were taken daily at about 08h30 and graphed. Thirty-four days after vaccination all the sheep were challenged i.v. with 5 ml infective blood and their reactions monitored as described above.

Every animal that showed a typical heartwater temperature reaction was treated by administering oxytetracycline intraperitoneally at a dosage rate of 10 mg/kg.

Experiment using goat kids

Pregnant goats were obtained and kept at the Veterinary Investigation Centre at Potgietersrus in a pen with a cement floor, under similar tick-free conditions to the sheep. They were allowed to kid in this pen. At the age of 2 weeks 7 kids were each injected intraperitoneally with 5 ml heartwater-infected blood. The same technique as that described above for the sheep was used.

Three weeks after this injection their immune status was challenged by administering 5 ml heartwater-infected blood i.v. via the jugular vein.

During the entire experiment daily rectal temperatures were taken and recorded as indicated above for the sheep.

Reacting animals were treated with Rolitetracycline administered intraperitoneally at a dosage rate of 10 mg/kg.

RESULTS

Experiment using adult sheep

Intraperitoneal vaccination group

Nine days after the injection of the heartwater-infected blood the rectal temperatures of 13 of the 14 sheep showed a slight increase of 1-1,5 °C. This slight fever persisted on the 10th day, but the temperature of all 13

⁽¹⁾ Request reprints from: Entomology Section, Veterinary Research Institute, Onderstepoort 0110.

⁽²⁾ These experiments were carried out during 1964 and have often been referred to as "Hurter, unpublished data".

Received 28 April 1987—Editor.

sheep was back to normal on the morning of the 11th day. No treatment was given. After i.v. challenge with 5 ml infective blood, 8 (57 %) of the 14 sheep did not react. When subsequently exposed to ticks on a known heartwater-infected farm they never showed any symptoms of heartwater up to the time of marketing 10 months later.

The other 6 sheep (43 %) in this group reacted to challenge. Treatment was purposely delayed to see whether they could overcome the reaction but all 6 died. The lesions at post-mortem examination were typical of heartwater, and the diagnosis was confirmed in all animals by demonstration of the parasites in brain smears.

Intravenous vaccination group

All 3 of the sheep injected i.v. with heartwater-infected blood started to react on the 9th day, as indicated by increased rectal temperatures. Two days later they showed typical symptoms of heartwater and rectal temperatures of 41 °C were recorded. Treatment, consisting of oxytetracycline administered intraperitoneally at a dosage rate of 10 mg/kg body mass, was instituted and they recovered uneventfully. All 3 sheep were found to be immune when challenged.

Untreated control group

Before challenge, no reactions were seen or recorded in the 3 unvaccinated sheep. However, after challenge 2 of the 3 sheep reacted after 10 days, then recovered after intraperitoneal treatment with oxytetracycline. The absence of any reaction in the remaining control animal could have been due either to the animal being refractory to heartwater or to faulty technique when the heartwater-infected blood was injected i.v. The first explanation probably applied as this sheep did not develop heartwater when it was subsequently grazed with the other sheep on a farm known to be heavily infected with this disease.

Experiment using goat kids

No clinical signs developed in any of the kids after the intraperitoneal injection of infected blood. However, when they were challenged 3 weeks later by means of the intravenous injection of infected blood, all 7 kids showed temperature reactions on the 9th day after injection. Treatment was delayed because it was hoped that the course of the disease would be modified by the immune response. This did not happen, and the clinical reactions were so severe that all the kids would probably have died had they not eventually been treated. The purpose of treating the 7 cases was not to determine the dosage of the drug required but to see whether the intraperitoneal injection of a tetracycline would be effective

for the treatment of severe cases of heartwater. Normally treatment would have been given in such cases on the 9th day, when their temperatures had reached 41 °C or higher.

After treatment on the 11th day, 6 of the 7 kids recovered uneventfully. In the 1 fatal case pneumonia was diagnosed as the cause of death.

DISCUSSION

Judging from the results of the intravenous challenge, the intraperitoneal injection of heartwater-infected sheep's blood apparently engendered immunity in 8 out of 14 sheep. The fact that only a slight temperature reaction followed after intraperitoneal injection requires further investigation, particularly in view of the subsequent infection and deaths of some of the animals which also reacted initially.

Unfortunately the numbers of sheep in the different groups were too small for proper statistical evaluation. This applies particularly to the control group, which served mainly to establish whether the heartwater blood used contained viable organisms. The fact that one of the 3 unvaccinated sheep failed to react to challenge would seem to indicate that, if this result were to be extrapolated to the field situation, the percentage of animals which are naturally resistant to heartwater is 33,3 %. It is well-known, though, that this is not so: only about 3–5 % are naturally resistant.

The results of the experiment conducted with goat kids were very disappointing in that none of the 7 kids developed any immunity after intraperitoneal vaccination. At this stage no explanation can be given for the difference between the result obtained in this experiment and that in which adult sheep were used.

Further controlled experiments are necessary before intraperitoneal vaccination can be advocated as an alternative to the intravenous route for the administration of infected blood.

Treatment with oxytetracycline and rolitetracycline by intraperitoneal injection, at the dosage rate of 10 mg/kg live mass, proved to be effective in controlling heartwater reactions.

The intraperitoneal administration of tetracyclines has the advantage that it causes no muscular damage which, in some cases, leads to the degrading of carcasses at abattoirs.

REFERENCE

- ALEXANDER, R. A., 1931. Heartwater. The present state of our knowledge of the disease. *17th Report of the Director of Veterinary Services and Animal Industry, Union of South Africa*, 89–150.